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BACKGROUND OF THE INVENTION

The present invention relates to a new and improved adjustable support or stand for an optical observation instrument.

The support or stand of this invention can be, for instance, used in conjunction with a telescope, binoculars, a camera, also for instance a TV-camera. However, according to a preferred environment of use, the invention is directed to a support or stand for a binocular microscope, as such can be employed for manufacturing or assembling precision mechanical, optical or electrical components, but also for carrying out surgical operations, especially brain surgery. During such use of observation instruments, the requirement exists of providing a support or stand, by means of which the observation instrument or device can be quickly and sufficiently selectively accurately oriented and appropriately brought into visual alignment with each localized zone or region of a larger area. Upon reaching the desired position and/or orientation the observation device must be able to be fixed in such selected position.

It should be recognized that especially when performing brain surgery, the surgeon is particularly dependent upon an observation device embodying a binocular microscope which he can adjust at a location which is not disturbing to him into a position for viewing the operation zone. He then uses such

binocular microscope for the microscopic observation of certain regions of the operating zone. Furthermore, the surgeon should be able to quickly and positively adjust the binocular microscope into the desired effective position so as to be an aid to him in carrying out incisions and surgical manipulations.

According to certain heretofore known constructions of stands suitable for this purpose there is arranged at a support which, for instance, through the agency of a spindle drive can be translatory adjusted in three coordinate directions, a pivot construction serving as means for rotating the observation device into its desired orientational position. In that case one is not concerned with a full Cardan or universal joint, rather a joint or hinge connection for selected orientational changes, for instance those undertaken along the surface of a cone about a given observation locality. With this type prior art construction it is not possible to quickly undertake in a direct manner the translatory spatial adjustments of the observation device. Quite to the contrary, the adjustment movement must be performed through three movement components parallel to the axes of a spatially fixed coordinate system. Additionally, with such type prior art support construction after having carried out the desired adjustment of the observation device into desired position and orientation, the observation device or the objective thereof must be additionally adjusted in the observation direction for the purpose of focusing.

These complicated actuation manipulations or operations which are here required and which are not matched to the motor reflexes of the human being hinder the doctor in his work which oftentimes entails quickly changing situations requiring correspondingly rapid and positive corrective measures.

Other stands for movable components, for instance for radioscope devices have become known to the art wherein the device to be adjusted is supported through the intermediary of multiple-axis Cardan joints at a support which in turn is spatially adjustable. Additionally, there is known to the art the use of a linkage parallelogram with weight balancing means for spatially adjusting an X-ray tube. Furthermore, there has also been proposed the construction of a stand for a binocular microscope which can be freely adjustable with regard to its position and orientation and by actuating a blocking mechanism can be rendered non-movable. With all of these known stand constructions, however, there are used, apart from the hinge joints, also axially displaceably mounted components. Since, however, all sliding bearings in the presence of forces applied at an inclination, and depending upon the encountered situation, result in periodic binding and uncontrolled detachment, the requirements of surgeons could not be previously satisfied with such type prior art stands.

In the environment of use under discussion it is of course desirable that the optical observation device should be capable of

adjustment as easily as magnifying glasses or binoculars which are simply held by the hand of the user, but must be capable of being fixed in every selected position.

SUMMARY OF THE INVENTION

Accordingly, from what has been stated above it will be seen that the art is still really in need of an adjustable support or stand for an optical observation instrument which is not associated with the aforementioned drawbacks and limitations of the prior art constructions. Hence, a primary object of this invention is to provide a new and improved construction of adjustable support or stand for an optical observation instrument which effectively and reliably fulfills the existing need in the art and overcomes the aforementioned limitations and drawbacks prevailing in the state-of-the-art constructions.

Still a further significant object of this invention relates to a novel construction of adjustable support or stand for an optical observation instrument wherein the positional adjustment of the observation instrument can be carried out quickly and easily in a most reliable and rapid fashion.

Yet a further significant object of this invention relates to an improved adjustable stand or support for an optical observation

instrument which allows for proper positioning or adjustment of the instrument quickly and reliably in an extremely simple and positive fashion.

Now in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the invention contemplates a novel adjustable support or stand for an optical observation instrument, preferably a binocular microscope, the position and/or orientation of which can be freely adjusted within a desired directed spatial area and fixed. To this end, the observation device is connected through the agency of a three-axes full Cardan or universal joint assembly at a spatially freely adjustable terminal piece of a pivot rod assembly mounted at a stationary support. The three-axes full Cardan joint assembly permits its free combinable rotational movement to be carried out by means of a handgrip about three axes which are perpendicular to one another. A stand or support construction of this type enables adjusting the observation instrument or device directly and in a controlled manner from a handgrip and it is simultaneously possible to orient such in the most favorable orientation direction with regard to the contemplated observation point or locality.

The terminal piece of the pivot rod assembly at which the observation device is attached through the agency of the three axes-full Cardan joint assembly is preferably a rod of a linkage parallelogram or another parallelogram guide arrangement which,

through the agency of a pivot axis of a pivot joint oriented transverse to its plane is supported at a column rotatably mounted at the stationary support. In the event all of the hinge or pivot joints of the entire stand construction are constructed as single axis roller body bearings which are poor in friction, then, there is obtained the best prerequisites for a blocking or release of all of the rotary- and adjustment movements of the observation device simultaneously electrically controlled by a switch, in that for the single-axis rotary or pivot joint there can be employed electro-magnetically actuatable braking devices of known construction.

It is also possible to deliver in an intermediate position of an actuation switch preferably arranged at the handgrip a periodically interrupted actuation current to electro-magnetically actuated brake devices for single-axis pivot joints. This subsequently simplifies the slower fine adjustment of the observation device following the course adjustment and carried out while completely releasing or unblocking all of the hinge connections or pivot joints.

By means of the inventive stand or support construction it is possible, without any difficulty, to balance out or compensate all of the gravitational moments of rotation of the three-axes full Cardan joint assembly and the observation device secured thereto with respect to the common point of intersection of the three rotational axes and to also balance out all gravitational moments of rotation of the entire stand with regard to the axis of rotation of its linkage parallelogram at the column which is rotatable about its vertical lengthwise axis at the stationary

support and, specifically in such a manner, that after releasing or unblocking the rotary bearing means of the observation device its position and orientation can be changed merely under the influence of external adjustment forces.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein :

Figure 1 is a schematic perspective view of the entire support or stand for an observation instrument or device as designed in accordance with the teachings of the present invention;

Figure 2 is an enlarged sectional view of an electromagnetically blockable rotatable mount or bearing arrangement for two lever arms;

Figure 3 is a circuit diagram suitable for actuating the bearing blocking arrangement; and

Figure 4 is a schematic view of an embodiment of mouth bar or clamp used as an aid for adjusting the binocular microscope and equipped with a de-blocking switch.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Describing now the drawings, in Figure 1 there is shown a preferred construction of inventive adjustable support or stand for an optical observation instrument, wherein at a stationary pedestal or support 10 there is rotatably mounted a stand column or upright 11 for rotation about its vertical axis A1. The associated bearing or mount BL1 is constituted by a single-axis roller body bearing having an electro-magnetically actuatable blocking mechanism. Details of a possible construction of such type blockable bearing are illustrated in Figure 2 of the drawings and will be considered more fully hereinafter.

Now at the end of a transversely extending arm 12 of the column 11 there is mounted a second blockable or lockable rotary bearing BL2, here shown oriented in a substantially horizontally extending axial direction A2, but which however is rotatable about the vertical axis A1. Now at this bearing BL2 there is pivotably mounted for movement about the axis A2 one rod 21 of a linkage parallelogram guide arrangement 2. The other rods of the linkage parallelogram 2 are designated by reference characters 22, 23 and 24. Now of the four connection joints of this linkage parallelogram 2 formed of the rods 21, 22, 23 and 24, and wherein the connection or hinge joints are each oriented in the direction of the axes A_2 and A_3 respectively, the one pivot or hinge joint connection BL3 is

likewise blockable, whereas the others, such designated by reference character L, are not lockable or blockable.

Now at an extension 230 of the linkage parallelogram rod or lever 23 there is mounted a balancing weight G which can be adjusted in such a fashion that the moment of rotation of the center of gravity of all movably mounted stand components can be balanced out or equalized with regard to the axis A2 of the rotary bearing means BL2.

Continuing, it will be observed that at an extension 240 of the parallelogram rod or lever 24 there is arranged a further blockable rotary bearing means BL4, oriented in the direction of the lengthwise axis A4 of such rod 24. This bearing means BL4 is adjustable at each point of a spatial zone or area R, shown in phantom lines in Figure I, and circularly surrounding the stand column 11, with the orientation of axis A4 being functionally dependent upon the achieved location.

One end of a Cardan-partial frame or support 31 is rotatably mounted at the bearing BL4 for rotation about its axis A4. The other end of this partial support 31 carries a blockable or lockable rotary bearing means BL5, the axis A5 of which is arranged so as to be always perpendicular to the axis A4 and intersects same. The one end of a second Cardan-partial support or frame 32 is rotatably mounted for movement about its axis A5 at the bearing means BL5, and at the

otbor ond thoroof thoro is arranged a blockable rotary bearing means BL6 in such a way that its axis of rotation A6 is always directed towards the point of intersection Z of the axes A4 and A5 or the rotary bearings BL4 and BL5 respectively.

Now, coaxially mounted for rotation at the rotary bearing means BL6 is a carrier or support rod 33 for the optical instrument or device 4, preferably here considered to be a binocular microscope. This support rod 33 is fixedly connected with a handle or bracket 34, at the ends of which there are formed or otherwise provided two handgrips 35. At one of these handgrips 35 there is arranged a deblocking or release switch 350 which acts upon the blocking mechanisms of all of the bearings means BL1, BL2, BL3, BL4, BL5, and BL6. Through the agency of this deblocking switch 350 it is possible to release the blocking mechanisms of all of these bearing means for the purpose of adjusting the binocular microscope 4 throughout all of its possible degrees of freedom of movement.

The binocular microscope 4 is adjustable at its support rod 33 in such a manner that all of the gravitational moments of rotation of the three-axes full Cardan joint arrangement or assembly 31, 32, 33 can be equalized or balanced out with respect to its three rotational axes A4, A5, A6, and specifically in such a manner that the common center of gravity of the components supported at the bearing means BL4 comes to lie at the point of intersection Z of all of these three axes.

On the other hand, through the agency of non-illustrated telescoping or extension devices or compensating weights it is possible to adjust the balancing weight G at the parallelogram rod 23 in such a manner that the center of gravity of all of the components movably supported at the bearing means BL2 of the entire stand or support comes to lie at the axis A2 of this bearing. In this way the binocular microscope 4 only adjusts itself under the influence of external adjustment forces even upon release of all of the bearing blocking devices, and which external adjustment forces only bring about an acceleration of the masses and need only overcome the frictional forces prevailing at the bearing means.

By virtue of this construction and arrangement, the observer, i.e., the assumed surgeon, can readily and easily adjust the binocular microscope 4, through the agency of the handgrips 35, while actuating the deblocking switch means 350, in a direct and intended manner throughout every desired orientation and for each desired point of a spatial work area or region. Further, upon releasing the deblocking switch means 350 the instrument i.e., microscope 4 is then blocked in the previously obtained adjusted position. In the event that the microscope is provided in known manner with a device for illuminating an image field 40, then, location or determination of the desired adjustments are facilitated.

It would, of course, be possible and it is within the

framework of the teachings of this invention, to replace the illustrated linkage parallelogram by many other different types of parallelogram guide arrangements having an analogous mode of operation.

Now in Figure 2 there is illustrated an embodiment of brake bearing means BL of the type employed a number of times in different sizes in the arrangement of Figure 1 as such has been explained above, and which has been designated in its entirety by reference character 5. This brake bearing means, after having been deblocked or released, serves to pivot both of the levers 51 and 52 relative to one another and about their connection axis A5.

The pivot pin or shaft 53 is suitably rigidly connected for rotation with the lever 51. A combination brake and bearing housing 54 rigidly connected with the other lever 52 is rotatably mounted at the shaft journal or pin 53 through the agency of both roller body bearings 55 and 56. A support disc 57 for one or a number of electromagnets 58 with therein mounted electrical coils 580 is rigidly mounted for rotation at the shaft journal 53. A brake disc 59 is rigidly connected for rotation with the housing 54 through the agency of the entrainment or fixing pins 590, but which is still axially displaceable, is situated opposite the electromagnets 58. During current flow through the magnet coils 580 the movable brake disc 59 is attracted against the electromagnets 58, and thereby blocks each rotational movement of the

lever 52 relative to the lever 51.

Now in Figure 3 there is illustrated by way of example a circuit diagram of circuitry suitable for the deblocking or release of the bearing means BL shown in Figure 2. Upon pressing the actuating or switching button 350 mounted at the handgrip 35 the contact s_3 is open during the first phase, so that the magnetic coils 580 are no longer continuously disposed at the working current circuit of the battery B, rather now only intermittently through the agency of the pulse transmitter IG. Consequently, the bearing BL which is equipped with the blocking mechanisms of the type shown in Figure 2 is now only intermittently released for the fine adjustment of the binocular microscope 4. When completely depressing the button or knob 350 the contact s_2 is also raised from the contact s_1 so that the coils 580 are now continuously without current and all adjustment movements of the microscope can be freely carried out without hindrance. Upon release of the switching button 350 the bearing means are again blocked.

Figure 4 of the drawing illustrates a mouthpiece or mouth bar 42 which can be used as an adjustment element aid for the binocular microscope 4 and containing mounted thereat a deblocking switch 42a as well as a forehead support 41 cooperating therewith. The support arrangement for the mouthpiece 42 and the forehead support 41 for the observer 400 are secured to the optical microscope 4 by means of the support means 441. A

shaft 43 is mounted for rotation about the axis A12 of the support roller pin 440 secured to the support means 44 and such shaft 43 is also suitably axially displaceably mounted, for instance in the sleeve 450. The forehead support 41 is arranged at the associated shafts 43 and 44 so as to be likewise rotatable about the axes A11 and A13 and also to be axially displaceable. The mouthpiece 42 is rotatably and axially displaceably arranged at the shaft 43. In order to fix the mouthpiece 42 and the forehead support 41 in the desired position there are advantageously provided fixing or adjustment screws 411, 412, 413 and 420.

Contacts 422' and 423' serving as switch components are arranged between two resilient mouthpiece components or portions 422 and 423 and which can be pressed together by a biting action exerted by the user upon the mouthpiece 42 against a resilient restoring force. These contacts 422' and 423' serving as the switch components together with the actuating or deblocking switch 350 (Figure 3) mounted at the handgrip 35 (Figure 1) form parallely connected deblocking switch means.

Upon biting together both mouthpiece portions 422 and 423 of the switch 42 the bearing blocking action at the stand is released and the observer 400 can directly and intentionally adjust, for every desired orientation and with regard to any desired point of his spatial activity, the observation device 4 in cooperation with the forehead support 41 and the mouthpiece

switch 42. After reaching the desired position the preasure exerted upon both of the resilient switch components 422 and 423 is released and therefore the blocking condition of the stand bearings is again established.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims. ACCORDINGLY,

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The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An adjustable stand for an optical observation instrument, especially for a binocular microscope, the position and/or orientation of which can be adjusted and fixed in a spatial area, comprising an observation instrument, a pivot rod assembly incorporating a terminal piece spatially freely adjustable through a combination of rotational movements, a stationary support for mounting said pivot rod assembly, and a three-axis full Cardan rod assembly for connecting said observation instrument with said freely adjustable terminal piece of said pivot rod assembly, and operating means for rendering possible the freely combined rotational movement of said three-axis full Cardan rod assembly about three axial directions which are perpendicular to one another.

2. The adjustable stand as defined in claim 1, wherein said operating means comprises a handgrip.

3. The adjustable stand as defined in claim 1, wherein said pivot rod assembly comprises a parallelogram guide arrangement, said terminal piece of said pivot rod assembly comprising a rod of said parallelogram guide arrangement, a column for supporting said pivot rod assembly rotatably mounted at said stationary support, and means providing a pivot axis for said parallelogram guide arrangement, which pivot axis is oriented transversely with respect to a plane containing said parallelogram guide arrangement, and wherein said means providing said transversely extending pivot axis operatively interconnects said parallelogram guide arrangement with said column.

4. The adjustable stand as defined in claim 3, wherein said parallelogram guide arrangement comprises a linkage parallelogram.

5. The adjustable stand as defined in claim 1, wherein said Cardan rod assembly and said pivot rod assembly incorporate a number of bearing means each providing single-axis pivot joints, each of said bearing means being formed of relatively frictionless roller body bearings.

6. The adjustable stand as defined in claim 5, wherein each of said number of roller body bearings incorporates a respective electrically operable blocking mechanism which can be selectively electrically switched-in and switched-out in such a manner that the observation instrument can be selectively fixed and adjusted, respectively, in each desired orientational position.

7. The adjustable stand as defined in claim 6, further including actuating switch means for operating said respective blocking mechanisms.

8. The adjustable stand as defined in claim 7, wherein said actuating switch means is arranged at said operating means, and said operating means comprises a handgrip provided for the observation instrument.

9. The adjustable stand as defined in claim 7, wherein said actuating switch means is movable into an intermediate position between its switching-in and switching-out positions, said actuating switch means when assuming said intermediate position delivering a periodically interrupted actuation current to said

blocking mechanisms of said bearing means.

10. The adjustable stand as defined in claim 5, further including means for balancing-out the moments of rotation of all of the masses of said full Cardan rod assembly and the observation instrument attached thereto with regard to the three axes of rotation and for balancing out all moments of rotation of the mass of the entire stand with regard to the axis of the bearing means of said parallelogram guide arrangement at the column rotatable about a vertical axis of rotation, such balancing-out being performed in such a manner that upon releasing said bearing means the position and/or orientation of the observation instrument does not alter without the influence of an external adjustment force.

11. The adjustable stand as defined in claim 1, further including a column rotatable about a vertical axis for supporting said pivot rod assembly and rotatably mounted at said stationary support, a blockable pivot bearing means provided for said column, a second blockable pivot bearing means for a rod member of said pivot rod assembly rotatable about a horizontal axis, said pivot rod assembly comprising a blockable linkage parallelogram which is pivotably mounted in a plane extending transverse to said horizontal axis, said linkage parallelogram including an output rod, a blockable pivot bearing carried by said output rod, said Cardan rod assembly incorporating a first Cardan support means rotatably mounted about the lengthwise axis of said output rod, a further blockable pivot bearing, said Cardan rod assembly

including a second Cardan support means mounted at said first Cardan support means via said further pivot bearing for rotation about an axis of rotation oriented perpendicular to the lengthwise axis of said output rod, said observation instrument incorporating support means, a still further blockable pivot bearing, said support means of said observation instrument being rotatably mounted at said second Cardan frame means via said still further blockable pivot bearing so as to rotate about an axis of rotation which is disposed perpendicular to the other axes of said Cardan rod assembly in such a manner that after deblocking all of said pivot bearings the observation instrument can be adjusted in every spatial orientation from each location of a limited spatial area exclusively through freely combined rotational movements of the support means about a multiplicity of rotational axes and each achieved position and orientation can be fixed by blocking the blockable pivot bearings.

12. The adjustable stand as defined in claim 11, wherein the gravitational rotational moments of all of the support means supported at the output rod of the linkage parallelogram and the observation instrument can be balanced-out with regard to the three-axis Cardan rod assembly and the point of intersection of such three axes, and that the entire gravitational rotational moment of said linkage parallelogram supported at said column can be balanced out with respect to said horizontal axis of rotation of said linkage parallelogram.

13. The adjustable stand as defined in claim 12, further including deblocking means arranged at said operating means of the observation instrument, wherein upon actuation of said deblocking means there is possible at least stepwise deblocking of all of the blocked pivot bearings.

14. The adjustable stand as defined in claim 13, wherein each of said blockable pivot bearings comprise a first support means carrying a support disc for at least two electromagnets and a second support means carrying a soft iron disc which can be movable axially in the direction of the common pole plane of the electromagnets and functioning as a blockable element.

15. The adjustable stand as defined in claim 13, wherein said operating means incorporates adjustment means constructed as a mouthpiece, said mouthpiece incorporating deblocking means actuated by biting down upon said mouthpiece.

16. The adjustable stand as defined in claim 15, further including an adjustable forehead support for the operator secured along with the mouthpiece to the observation instrument, said adjustable forehead support cooperating with said mouthpiece.

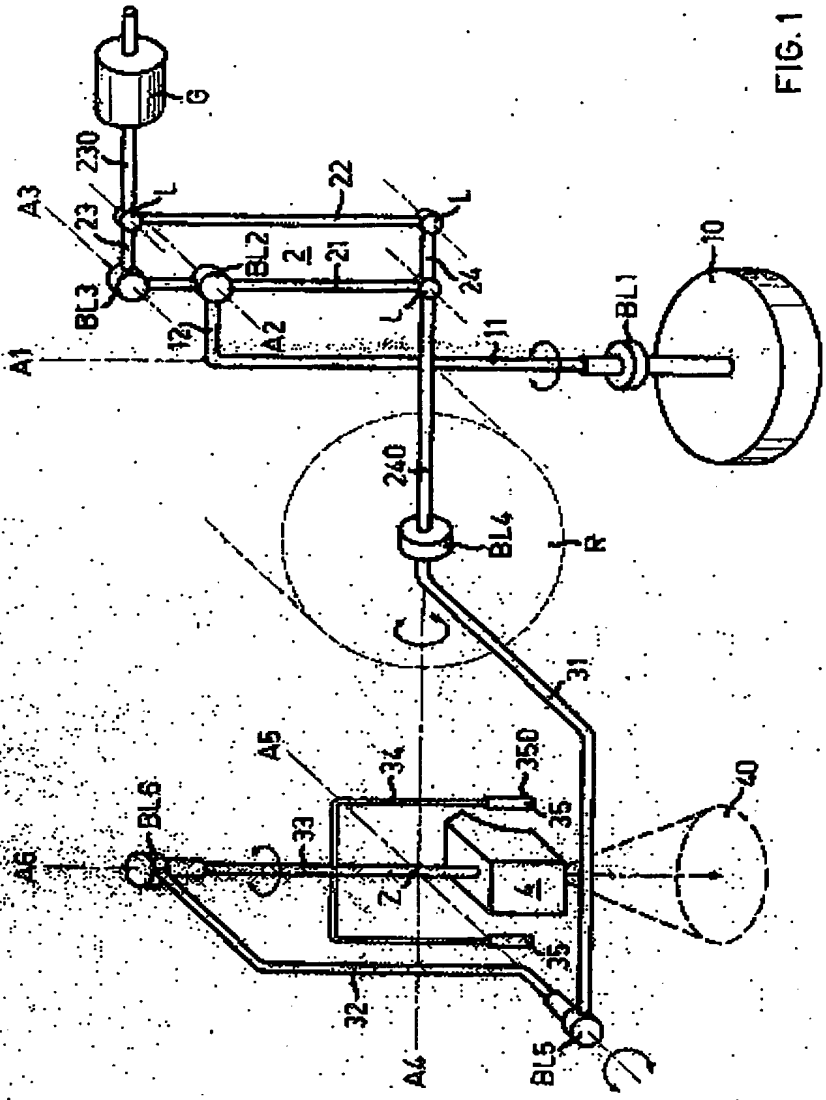

FIG. 1

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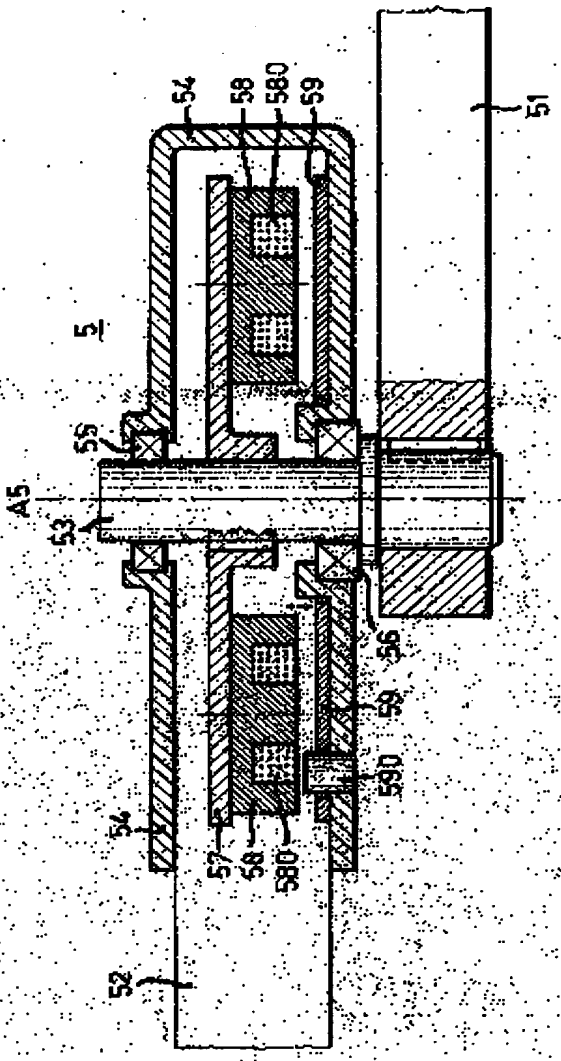
FIG. 2



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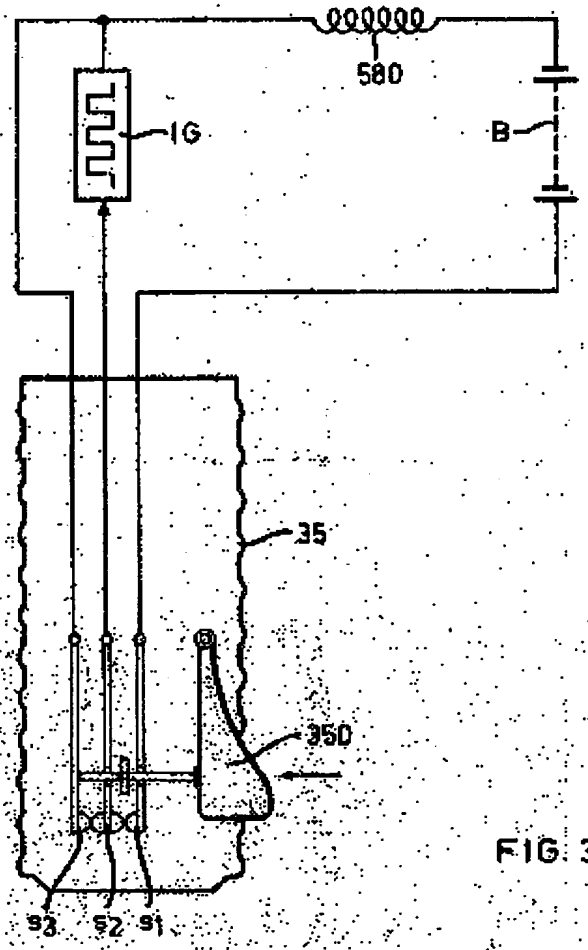

FIG. 3

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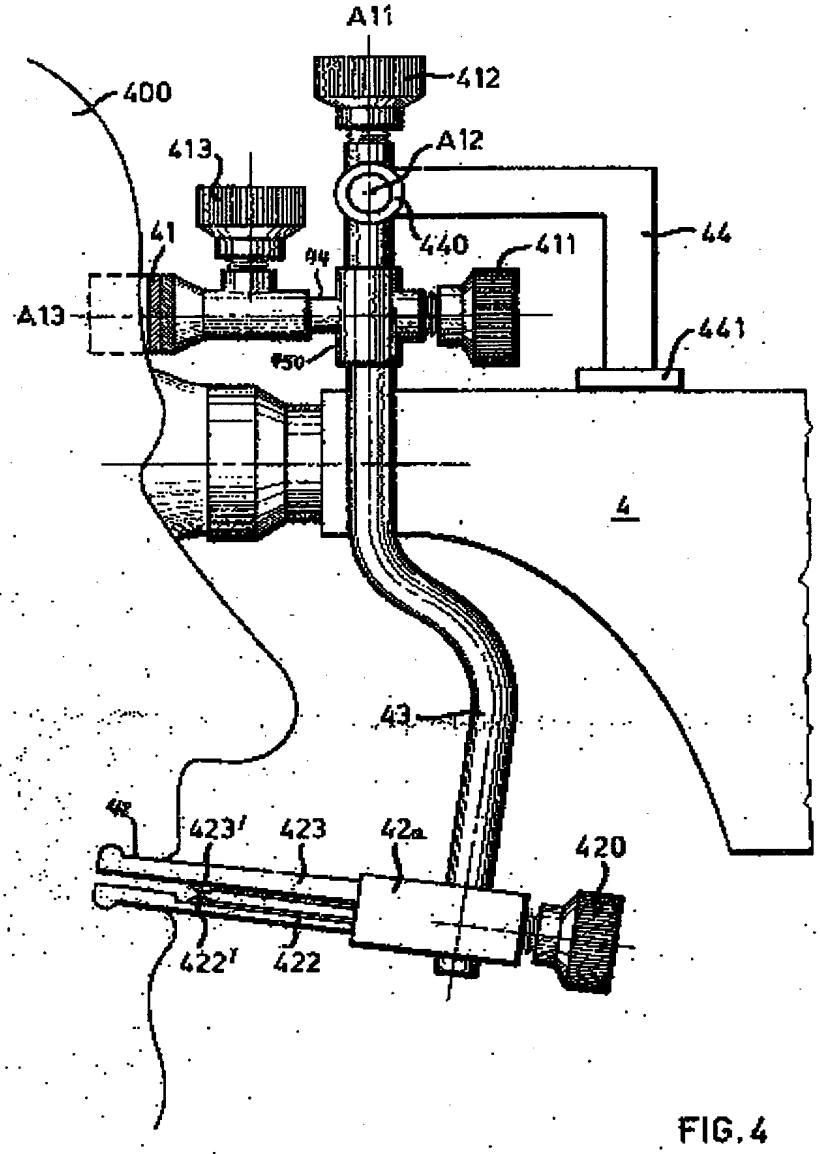

FIG. 4

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